National Institute of Environmental Health Sciences

Projection of climatic suitability for Aedes albopictus Skuse (Culicidae) in Europe under climate change conditions

Author(s): Fischer D, Thomas SM, Niemitz F, Reineking B, Beierkuhnlein C
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Abstract:

During the last decades the disease vector Aedes albopictus (Ae. albopictus) has rapidly spread around the globe. The spread of this species raises serious public health concerns. Here, we model the present distribution and the future climatic suitability of Europe for this vector in the face of climate change. In order to achieve the most realistic current prediction and future projection, we compare the performance of four different modelling approaches, differentiated by the selection of climate variables (based on expert knowledge vs. statistical criteria) and by the geographical range of presence records (native range vs. global range). First, models of the native and global range were built with MaxEnt and were either based on (1) statistically selected climatic input variables or (2) input variables selected with expert knowledge from the literature. Native models show high model performance (AUC: 0.91-0.94) for the native range, but do not predict the European distribution well (AUC: 0.70-0.72). Models based on the global distribution of the species, however, were able to identify all regions where Ae. albopictus is currently established, including Europe (AUC: 0.89-0.91). In a second step, the modelled bioclimatic envelope of the global range was projected to future climatic conditions in Europe using two emission scenarios implemented in the regional climate model COSMO-CLM for three time periods 2011-2040, 2041-2070, and 2071-2100. For both global-driven models, the results indicate that climatically suitable areas for the establishment of Ae. albopictus will increase in western and central Europe already in 2011-2040 and with a temporal delay in eastern Europe. On the other hand, a decline in climatically suitable areas in southern Europe is pronounced in the Expert knowledge based model. Our projections appear unaffected by non-analogue climate, as this is not detected by Multivariate Environmental Similarity Surface analysis. The generated risk maps can aid in identifying suitable habitats for Ae. albopictus and hence support monitoring and control activities to avoid disease vector establishment.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: COSMO-CLM

Early Warning System:

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Precipitation, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: General Mosquito-borne Disease

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content